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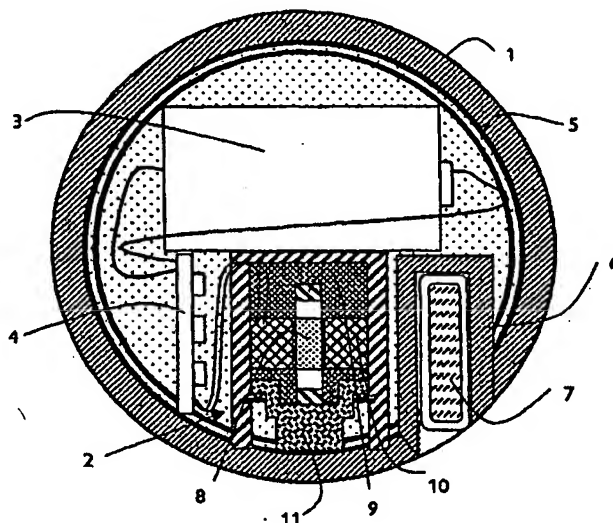
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(54) Title: **CLEANING AID**



(57) Abstract: A device for use in cleaning fabric articles comprises a fluid-tight self-contained body (1) containing a power source (3) and means (2, 4) for generating ultrasonic vibrations. The device is suitable for use within a washing machine, or it may be hand held for localised treatment of fabrics, for example stain removal. The device can be adapted to dispense treatment agents, controlling the rate of dissolution of different layers from a solid tablet, for example, by the controlled application of ultrasonic vibration to the tablet. For example, different frequencies can be used to assist in dissolution of different layers.

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For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

CLEANING AID

Field of the Invention

This invention relates to a device for use in cleaning fabric articles, and to a method for cleaning fabric articles. The invention also provides a device for the controlled release of treatment agents, for example in a fabric washing machine.

Background to the Invention

Conventional washing machines for clothing and other fabric articles operate by agitating the articles in a drum containing water and detergent, usually with some degree of heating of the water. While such machines provide adequate cleaning for most purposes, difficult soiling or staining of the articles is typically dealt with by the application of specialised additional detergents or by special pre-treatment. A result is the use of additional energy, which is costly to the user and undesirable in global terms, and/or additional chemical compounds, presenting problems of disposal, with possible adverse effects on sewage/waste water treatment plant.

The present invention seeks to increase the effectiveness of existing washing machines without the need for additional chemicals, and indeed presenting the possibility of reducing detergent use, with minimal increase in energy consumption.

Summary of the Invention

According to the invention, there is provided a device for use in cleaning fabric articles, comprising a fluid-tight self-contained body containing a power source and means for generating ultrasonic vibrations of an amplitude and frequency such that a cleaning action is exerted on liquid-containing fabric articles in proximity thereto.

The device can simply be loaded with the fabric articles into a washing machine, the emission of ultrasound during the normal washing cycle serving to enhance the washing action. Alternatively, the device could be employed as a hand-held device for use in localised fabric treatment, for example for the removal of stains in conjunction with a treatment fluid, which could be, for example, water, a detergent solution, or a dry-cleaning fluid.

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The action of the ultrasonic vibrations on the fabric is to assist in breaking down the mechanical or chemical bonding of the contaminants to the fabric fibres. In water, cavitation effects can enhance this action.

Preferably, the means for generating ultrasonic vibrations comprises a magnetostrictive actuator employing giant magnetostrictive material (GMM), and a signal generator. The signal generator may be arranged to produce a constant fixed frequency, or to provide a variable frequency. The signal generator may be arranged to be activated in response to movement of the device, so that it ceases to operate when the machine wash cycle finishes, for example, or to be activated in response to a predetermined type of movement, for example operating during the normal washing action, but becoming deactivated when the spin cycle operates, thereby conserving power in the device.

The power source is suitably a battery, preferably a rechargeable battery which can be charged by inductance coupling with a recharging station when the device is not in use. In this way, the need for external charging contacts is avoided, and the fluid-tight sealing of the body is therefore simplified.

The body, which is suitably configured as a sphere (although other shapes may also be employed), may be provided with a slot to receive and dispense detergent, for example in the form of a solid tablet or stick. Additionally or alternatively, other materials may be dispensed, for example fragrance, fabric conditioner, water softener, stain removal materials, especially for localised action, or materials to release bubbles to enhance the cleaning action of the ultrasonic vibrations.

In a preferred embodiment, tablets are configured with layers of different treatment materials whose rate of dissolution in water is greatly increased by the application of ultrasonic energy, and different layers may be dissolved at different frequencies and/or amplitudes. The device may then be provided with control means to change the ultrasonic frequency, or simply to switch on and off, according to a predetermined time pattern to control the release of the different treatment materials at the appropriate times in the wash cycle. Tablets having different layer structures may be provided for different types of wash, for example heavy or light soiling, and different

fabric types. The tablets or sticks may have successive layers of materials in the manner of an onion skin, but are preferably layered along the length thereof, so that material is released in sequence from one exposed end.

The control means may be programmed to operate with different tablets by any
5 convenient means, for example by transmitting instructions to the control means from the recharging station by means of inductive coupling in a manner comparable with communication with non-contact smart cards, or possibly by a short-range high frequency radio link. Alternatively, or additionally, the device may be provided with sensor means to detect different external temperatures and to influence the pattern of ultrasonic energy in response thereto.
10

In one embodiment, it may be possible to control the operation of the device in accordance with fabric and/or cleaning information stored in and transmitted by electronic tags or labels attached to the fabric articles. The control means in the device may be arranged to receive information transmitted from such tags or labels direct, or via
15 the recharging station, which is adapted to receive the information from the labels direct or from sensors in the washing machine. The operation of the device, and in particular in relation to the release of treatment materials thereby, may thus be programmed according to the balance of fabric articles contained in the wash load.

The device of the invention provides for the possibility of improving the washing
20 efficiency of existing washing machines without any adaptation of the machine itself, as well as more sophisticated control over the washing process.

The invention further provides a method of cleaning fabric articles, comprising agitating the articles in a cleaning fluid, and including with the articles a device according to the invention.

25 The cleaning fluid will typically be water, with or without detergent and other additives, or it may be other types of cleaning fluid, such as dry-cleaning solvent.

Another aspect of the invention provides a device for controlling the dispensing of fabric treatment materials, comprising a fluid-tight self-contained body containing a power source, receiving means for receiving a body of treatment material, and means

for generating ultrasonic vibrations to assist in release of treatment material from the receiving means.

The device according to this aspect of the invention is able to dispense treatment materials in a controlled manner, for example by providing the treatment materials in the form of a solid body built up of layers of different materials to be released at different stages in the cleaning cycle with which it is to be used. For example, in the case of fabric washing, a pre-wash material may be released first, followed by a main wash detergent, and then a fabric conditioner and finally a freshening perfume.

While this aspect of the invention is particularly useful for the treatment of fabric articles, it is envisaged that the device could be employed in other types of cleaning, for example in a dishwasher, more precisely timing the release of different treatment agents than can be achieved by the use of multi-layer tablets or the like which are simply intended to dissolve at different rates, and which cannot prevent premature release of selected materials.

15 **Brief Description of the Drawings**

In the drawings, which illustrate diagrammatically an exemplary embodiment of the invention:

Figure 1 is a cross-sectional view of the device; and

Figure 2 is a cross-sectional view on a reduced scale of a charging station for the device, with the device located therein

20 **Detailed Description of the Illustrated Embodiment**

The device consists of a sealed spherical body 1, for example of a plastics material, containing a magnetostrictive actuator 2 adapted to emit ultrasonic vibrations through the casing to the surrounding fabric-containing wash water. The actuator 2 is powered by a rechargeable battery 3 via a signal generator/controller circuit 4. The battery 3 is in turn recharged by inductive coupling from a recharging station such as is shown in Figure 2 with internal coils 5 of suitable configuration. A sealed slot 6 is provided in the body 1 to receive a tablet 7 of a washing aid material, for example a detergent, a stain remover, a fabric conditioner, a water softener, or a fragrance, or a layered combination of these arranged to be released in the appropriate part of the wash

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cycle. For example, the layers may be built up on the exposed end of the tablet when placed in the slot, so as to be released in sequence without allowing the tablet to fall out of the slot. The dissolution of the layers may be accelerated by the application of different ultrasonic frequencies, for example, permitting control over the release by programming the device accordingly:

The magnetostrictive actuator 2 may, for example, include a rod of GM Material 8 held between a pair of magnets 9 and located inside an electromagnet coil 10 connected to the signal generator 4 so as to elongate and contract in accordance with the applied signal, thereby transmitting the ultrasonic vibrations via a foot 11 to the exterior of the body 1.

Figure 2 illustrates the recharging of the battery by placing the body 1 in a recharging station 20 provided with a hemispherical recess to receive the body. Within the casing of the station 20, induction coils 21 run around the recess to provide for inductive coupling of power into the coils 5 within the body. In addition, the coils 21 may permit signalling to the electronic circuit 4 within the body, for example to select a different cycle of ultrasonic output to suit different conditions within the washing machine or to control the release of the layers of different materials within the tablet 7 shown in Figure 1. The station 20 is provided with a mains electrical lead 22, connected within the stations casing to an electrical transformer 23 to step down the main voltage to an appropriate level for operation of the electronic components, say from 6V to 12V. The coils 21 are connected to a control circuit 24 supplied with power from the transformer. The station 20 may be configured to detect the presence or absence of the device thereon and to switch to a quiescent state in the absence of the device, both for safety reasons and to save power.

While the device described with reference to the drawings is primarily intended to be used within a washing machine during the wash cycle, it may be desirable to use the device in the direct treatment of stains and the like before the fabric article is placed in a washing machine. The device may thus be adapted for hand use, both in the shape, rendering the device more ergonomically useful, and in providing for the dispensing of stain removal materials in conjunction with the treatment. The release of the treatment

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materials may be triggered by the action of the ultrasonic vibrations, or some other dispensing means may be employed, for example a pump dispenser.

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CLAIMS

1. A device for use in cleaning fabric articles, comprising a fluid-tight self-contained body containing a power source and means for generating ultrasonic vibrations of an amplitude and frequency such that a cleaning action is exerted on liquid-containing fabric articles in proximity thereto.
5
2. A device according to Claim 1, wherein the means for generating ultrasonic vibrations comprises a magnetostrictive actuator employing giant magnetostrictive material (GMM), and a signal generator.
3. A device according to Claim 2, wherein the signal generator is arranged
10 to produce a constant fixed frequency.
4. A device according to Claim 2, wherein the signal generator is arranged to provide a variable frequency.
5. A device according to any preceding claim, wherein the signal generator is arranged to be activated in response to movement of the device.
- 15 6. A device according to Claim 5, wherein the signal generator is arranged to be activated in response to a predetermined type of movement.
7. A device according to any preceding claim, wherein the power source is a rechargeable battery.
8. A device according to Claim 7, wherein the device contains inductance
20 coils for recharging the battery, and an external charging station is provided for receiving the device, the station having inductance coils co-operating with the inductance coils in the device.
9. A device according to any preceding claim, wherein the body is generally spherical.
- 25 10. A device according to any preceding claim, wherein the body is provided with a slot therein for receiving a tablet of a treatment agent.
11. A device according to any preceding claim, comprising control means for controlling the operation of the signal generator.
12. A device according to Claim 11, wherein the control means includes a
30 radio receiver for receiving instructions for the operation of the device.

13. A device according to Claim 11 or 12, comprising sensor means connected to the control means and arranged to sense conditions external to the device.

14. A method of cleaning fabric articles, comprising agitating the articles in a cleaning fluid, and including with the articles a device according to any preceding claim.

5 15. A device for controlling the dispensing of fabric treatment materials, comprising a fluid-tight self-contained body containing a power source, receiving means for receiving a body of treatment material, and means for generating ultrasonic vibrations to assist in release of treatment material from the receiving means.

10 16. In combination, a device according to Claim 15 and a solid tablet adapted to be received and held in the receiving means and comprising a plurality of layers of different materials which are more readily dissolved in water under the influence of ultrasonic vibrations.

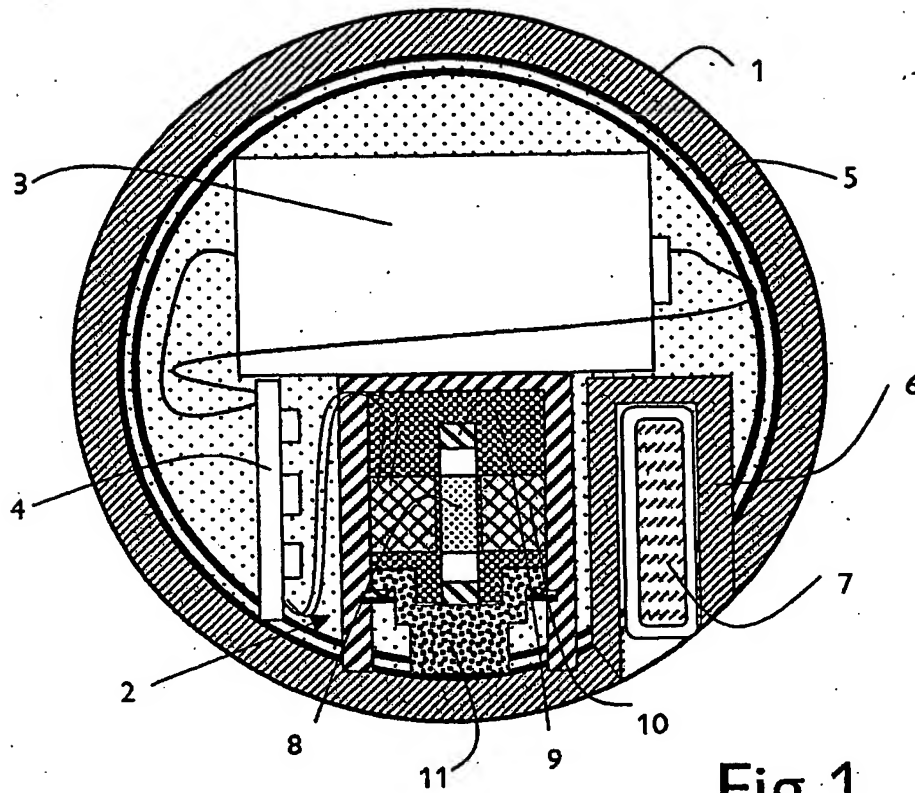


Fig 1

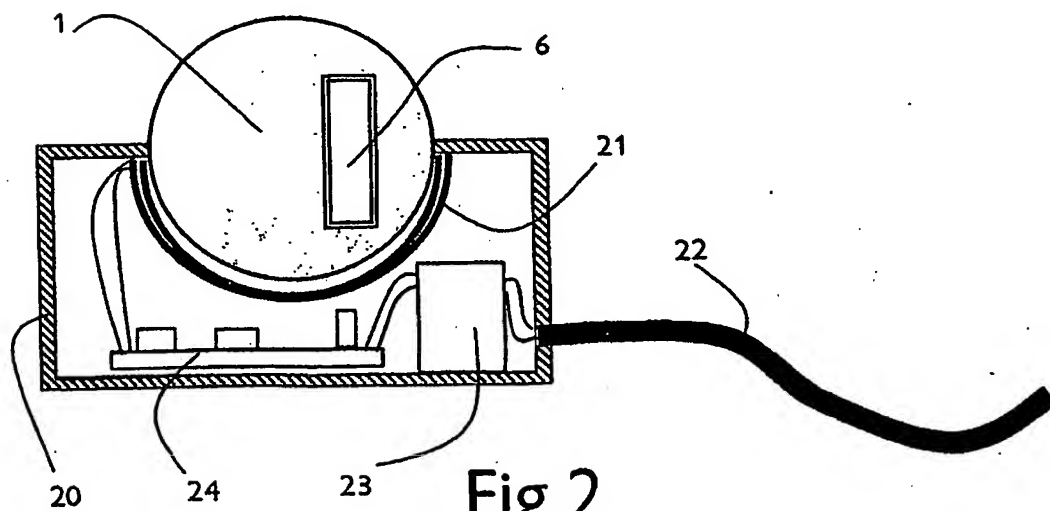


Fig 2

INTERNATIONAL SEARCH REPORT

International Application No

PCT/GB 02/03850

A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
 IPC 7 D06F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X A	US 5 697 230 A (WASH-BALL AG.) 16 December 1997 (1997-12-16) the whole document	1,7-9, 11,13-15 2,3,10, 16
X A	DE 93 19 129 U (GERST-ELECTRON) 19 May 1994 (1994-05-19) claims; figure	1,7-9, 11,14 3,15
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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T later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

X document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

Y document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

Z document member of the same patent family

Date of the actual completion of the international search

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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